UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/822,414	04/02/2001	Hiroya Kirimura	P107351-00011	9442

7590 06/02/2005

ARENT FOX KINTNER PLOTKIN & KAHN, PLLC
SUITE 600
1050 CONNECTICUT AVENUE, N.W.
WASHINGTON, DC 20036-5339

EXAMINER	
SONG, MATTHEW J	
ART UNIT	**PAPER NUMBER**
1722	

DATE MAILED: 06/02/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/822,414	KIRIMURA ET AL.	
	Examiner	Art Unit	
	Matthew J. Song	1722	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 January 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *16-32* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *16-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 16 is rejected under 35 U.S.C. 102(b) as being anticipated by Sakai (JP 03-248574), an English Translation (ET) and English Abstract have been provided.

In a method of crystallizing amorphous silicon, note entire translation, Sakai discloses a amorphous silicon film **14** containing no hydrogen is formed on the surface of a substrate, this reads on applicant's pre-film, through an optical CVD method in a furnace **13** and laser annealing by an excimer laser device **19** is executed to the surface of the amorphous silicon film **14**, this reads on applicant's energy beam, and the surface of the amorphous silicon film is crystallized to form a polysilicon film **21**. Sakai also discloses a thermal treatment process for removing hydrogen can be omitted (English Abstract). Sakai also discloses the device is brought into a vacuum atmosphere (ET pg 7), this reads on applicant's vacuum chamber. Sakai also discloses the amorphous silicon film and the polysilicon film can be formed continuously as the substrate is arranged in the furnace **13** and an improvement in efficiency can be engineered (ET pg 7).

3. Claims 17-19, 22, 23, and 31 are rejected under 35 U.S.C. 102(e) as being anticipated by Asakawa et al (US 5,795,385).

In a method of forming a single crystalline thin film by beam irradiation, note entire reference, Asakawa et al discloses forming an amorphous silicon film on a substrate using plasma chemical vapor deposition, this reads on applicant's prefilm, while simultaneously irradiating the substrate with beams of low energy gas, this reads on applicant's energy beam (col 4, ln 30-67). Asakawa et al also discloses the amorphous thin film is converted to form a single crystalline film (col 4, ln 30-50). Asakawa et al teaches the substrate can be scanned by a substrate moving means, whereby it is possible to from a single crystalline thin film having high homogeneity on a long substrate (col 10, ln 5-45; Eleventh Preferred Embodiment). Asakawa et al also teaches it is possible to facilitate formation of an amorphous thin film by intermittently applying beams from an ion source while regularly supplying a reaction gas and rotating the substrate during application pauses (col 12, ln 1-50). Asakawa et al also teaches neon ions can be accelerated to 200-600 eV by an ion source **83** (col 23, ln 20-55). Asakawa et al also teaches a plasma CVD process (col 32, ln 1-67). Asakawa et al also teaches a reaction chamber coupled to a vacuum unit (col 27, ln 1-15), this reads on applicant's vacuum chamber.

Referring to claim 16, Asakawa et al discloses supplying a reaction gas onto a substrate allowing no crystallization of the material with plasma CVD while simultaneously irradiating the substrate with beams of low energy gas to covert the amorphous film to a crystal having a regulated crystal orientation (col 4, ln 30-67). Asakawa et al does not discloses a dehydrogenation process, this reads on applicant's limitation of without conducting a dehydrogenation process. Furthermore, the crystallization of the amorphous film with the energy

beam occurs simultaneously with the formation of the amorphous film; therefore a dehydrogenation process cannot occur and a dehydrogenation process, as described by applicant's, requires a separate heat treatment, which is not taught by Asakawa et al.

Referring to claim 17, Asakawa et al teaches the substrate can be scanned by a substrate moving means, whereby it is possible to from a single crystalline thin film having high homogeneity on a long substrate (col 10, ln 5-45; Eleventh Preferred Embodiment), this reads on applicant's concurrently operating the energy beam device to irradiate

Referring to claim 19, Asakawa et al teaches a pre-film of the crystalline silicon film is formed on the target surface while emitting an ion beam to the substrate in the step of form the pre-film by the film forming device (col 4, ln 50-67).

Referring to claims 22-23, Asakawa et al teaches formation of an amorphous film by intermittently applying beams from an ion source while supplying reaction gas, this reads on applicant's ion beam is emitted to the target surface of the substrate in an initial stage of the forming of the pre-film.

Referring to claim 31, Asakawa et al teaches plasma CVD (col 33, ln 20-45).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakai (JP 03-248574), an English translation (ET) and English Abstract have been provided, as applied to claims 16 above, and further in view of Fan et al (US 4,309,225).

Sakai discloses all of the limitations of claim 17, as discussed previously in claim 16, except operating the energy beam irradiation device to irradiate the formed pre-film with the energy beam while moving the substrate in a second direction crossing the first direction.

In a method of forming an amorphous material with a moving energy beam, Fan et al teaches how to provide continuous, controlled motion of a crystallization front in an amorphous material by controlling parameters such as the rate at which a laser beam or other beam of energy is moved across an amorphous material (col 2, ln 1-67). Fan et al also discloses scanning of a semiconductor can be achieved by mounting a sample chamber on translational stages **28,30** and **32** provide the capability to move the chamber and thus the semiconductor in the x, y, and z directions, this reads on applicant's moving the substrate in a second directions. Fan et al also discloses each stage can be driven separately or simultaneously and the rate at which each stage

can be driven is variable (col 4, ln 25-67; col 5, ln 1-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Sakai with Fan et al to obtain continuous, controlled motion of a crystallization front in an amorphous material.

6. Claim 20-21, and 24-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Asakawa et al (US 5,795,385) applied to claim 17-19, 22, 23, and 31 above, and further in view of Selvakumar et al (US 5,633,194).

Asakawa et al teaches all of the limitations of claim 21, as discussed previously in claim 17, an ion beam is emitted to the target surface of the substrate from the ion source prior to the step of forming the pre-film

In a method of forming epitaxial grown Si utilizing ion beams (col 1, ln 35-65), Selvakumar et al teaches in-situ cleaning of a substrate surface by argon ion bombardment prior to the start of deposition, where a 200 eV argon ion beam was used to sputter clean the substrate in a necessary step which significantly influences the quality of a grown film by removing native oxide. Selvakumar et al also discloses an inexpensive ion beam vapor deposition technique used to grow silicon films, where an ion source **13** was used to ionize a gas to accelerate an ion beam towards a substrate with a current between 30-1000 eV using high purity argon and silane gases as sources for the ion beam (col 6, ln 20-65; col 7, ln 1-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Asakawa et al with Selvakumar et al to clean the substrate.

Referring to claim 26-29, the combination of Asakawa et al and Selvakumar et al teaches an ion beam where a current can be adjusted between 30-1000 eV and a cleaning at 200 eV.

Overlapping ranges are held to be obvious (MPEP 2144.05). Furthermore, It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Asakawa et al and Selvakumar et al by optimizing the emission energy by conducting routine experimentation.

Referring to claim 30, Overlapping ranges are held to be obvious (MPEP 2144.05).

7. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Asakawa et al (US 5,795,385) as applied to claims 17-19, 22, 23, and 31 above, and further in view of Ahn et al (US 5,470,619).

Asakawa et al discloses all of the limitations of claim 32, as discussed previously, except plasma CVD using hydrogen gas.

In a method of forming amorphous silicon films using plasma CVD, note entire reference, Ahn et al teaches a substrate placed in a PECVD chamber heated from room temperature to 600°C in an atmosphere of a source gas to deposit an amorphous silicon film, thereon. Ahn et al also teaches using Si_2H_6 or H_2 diluted SiH_4 as a source, which is less expensive.

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Asakawa et al by using a H_2 diluted SiH_4 source gas because it is conventionally known in the art to be used in plasma CVD processes to from amorphous silicon and it is less expensive, thereby reducing cost.

Response to Arguments

8. Applicant's arguments, see page 8 of the remarks, filed 1/18/2005, with respect to the rejection(s)of claim(s) 16, 20, 22, 24, 26, 28, 29, 31 and 32 over the Zhang et al reference have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Sakai (JP 03/248574) and Asakawa et al (US 5,795,385).

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on 571-272-1137. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song
Examiner
Art Unit 1722

MJS
May 30, 2005

ROBERT KUNEMUND
PRIMARY EXAMINER